

Having described the invention, we claim the following:

1. A vehicle restraint system for helping to restrain a vehicle occupant in a vehicle seat, the vehicle restraint system comprising:

first and second lap belts for collectively extending across a lap of the occupant;

first and second shoulder belts for extending over the shoulders of the occupant;

a buckle assembly for interconnecting the lap belts and the shoulder belts;

first and second lap belt retractors for the first and second lap belts, respectively, the first and second lap belt retractors being spaced away from one another and enabling retraction and withdrawal of the first and second lap belts, respectively; and

a linking mechanism connecting the first and second lap belt retractors and adapted to transfer motion between the first and second lap belt retractors so that the first and second lap belts are retracted in unison and by equal amounts during retraction and are withdrawn in unison and by equal amounts during

withdrawal from the first and second lap belt retractors.

2. The vehicle restraint system of claim 1 wherein the linking mechanism includes first and second sprocket wheels and a chain, the first sprocket wheel being fixed for rotation with a first spool of the first lap belt retractor and the second sprocket wheel being fixed for rotation with a second spool of the second lap belt retractor, the chain connecting the first and second sprocket wheels and transferring motion between the first and second sprocket wheels.

3. The vehicle restraint system of claim 2 wherein the first spool rotates in a direction opposite to the second spool during retraction and withdrawal of the first and second lap belts, the chain including portions that cross one another in an area between the first and second lap belt retractors for enabling rotation of the first and second spools in opposite directions.

4. The vehicle restraint system of claim 3 wherein the chain is formed from a flexible material

and includes opposite side surfaces, each of which is adapted to engage the first and second sprocket wheels.

5. The vehicle restraint system of claim 2 wherein the first spool is identical to the second spool and the first sprocket wheel is identical to the second sprocket wheel.

6. The vehicle restraint system of claim 2 wherein a spacer wall also connects the first and second lap belt retractors, the spacer wall being adapted to move relative to the first and second lap belt retractors to tension the chain.

7. The vehicle restraint system of claim 2 further including first and second shoulder belt retractors for the first and second shoulder belts, respectively, the first and second shoulder belt retractors enabling retraction and withdrawal of the first and second shoulder belts, the first and second shoulder belt retractors being linked together so that the first and second shoulder belts are retracted in unison and by equal amounts during retraction and are withdrawn in unison and by equal amounts during

withdrawal from the first and second shoulder belt retractors.

8. The vehicle restraint system of claim 7 wherein a universal joint connects the first and second shoulder belt retractors, the universal joint connecting a first axle of a first spool of the first shoulder belt retractor and a second axle of a second spool of the second shoulder belt retractor.

9. The vehicle restraint system of claim 8 wherein the universal joint includes first and second segments that are pivotally connected to one another about a first pivot axis, the universal joint being adapted to compensate for misalignment about the first pivot axis between the first and second shoulder belt retractors.

10. The vehicle restraint system of claim 9 wherein the universal joint further includes a third segment that is pivotally connected to the second segment about a second pivot axis, perpendicular to the first pivot axis, the universal joint being adapted to

compensate for misalignment about the second pivot axis between the first and second shoulder belt retractors.

11. The vehicle restraint system of claim 1 wherein the linking mechanism includes first and second gear wheels and a gear drive assembly, the first gear wheel being fixed for rotation with a first spool of the first lap belt retractor and the second gear wheel being fixed for rotation with a second spool of the second lap belt retractor, the gear drive assembly connecting the first and second gear wheels and transferring motion between the first and second gear wheels.

12. The vehicle restraint system of claim 11 wherein the first spool rotates in a direction opposite to a direction in which the second spool is rotating during retraction and withdrawal of the first and second lap belts, the gear drive assembly being located in an area between the first and second lap belt retractors and including an even number of drive assembly gear wheels for enabling rotation of the first and second spools in opposite directions.

13. The vehicle restraint system of claim 12 wherein the first spool is identical to the second spool, the first gear wheel is identical to the second gear wheel, and the drive assembly gear wheels are identical to one another.

14. The vehicle restraint system of claim 11 further including first and second shoulder belt retractors for the first and second shoulder belts, respectively, the first and second shoulder belt retractors enabling retraction and withdrawal of the first and second shoulder belts, the first and second shoulder belt retractors being linked together so that the first and second shoulder belts are retracted in unison and by equal amounts during retraction and are withdrawn in unison and by equal amounts during withdrawal from the first and second shoulder belt retractors.

15. The vehicle restraint system of claim 14 wherein a universal joint connects the first and second shoulder belt retractors, the universal joint connecting a first axle of a first spool of the first

shoulder belt retractor and a second axle of a second spool of the second shoulder belt retractor.

16. The vehicle restraint system of claim 15 wherein the universal joint includes first and second segments that are pivotally connected to one another about a first pivot axis, the universal joint being adapted to compensate for misalignment about the first pivot axis between the first and second shoulder belt retractors.

17. The vehicle restraint system of claim 16 wherein the universal joint further includes a third segment that is pivotally connected to the second segment about a second pivot axis, perpendicular to the first pivot axis, the universal joint being adapted to compensate for misalignment about the second pivot axis between the first and second shoulder belt retractors.

18. The vehicle restraint system of claim 1 further including an indication system, the indication system including tension sensors for sensing tension in the first and second lap belts, respectively, and an indicator for indicating to an occupant that the first

and second lap belts and the first and second shoulder belts are not being worn correctly when the sensed tension in the first lap belt differs by a predetermined amount from the sensed tension in the second lap belt.

19. A vehicle restraint system for helping to restrain a vehicle occupant in a vehicle seat, the vehicle restraint system comprising:

first and second lap belts for collectively extending across a lap of the occupant;

first and second shoulder belts for extending over the shoulders of the occupant;

a buckle assembly for interconnecting the lap belts and the shoulder belts;

first and second lap belt retractors for the first and second lap belts, respectively, the first and second lap belt retractors being spaced away from one another and enabling retraction and withdrawal of the first and second lap belts, respectively; and

a gear drive assembly connecting the first and second lap belt retractors and adapted to transfer motion between the first and second lap belt retractors so that the first and second lap belts are retracted in



unison and by equal amounts during retraction and are withdrawn in unison and by equal amounts during withdrawal from the first and second lap belt retractors.

20. The vehicle restraint system of claim 19 wherein a first gear wheel is fixed for rotation with a first spool of the first lap belt retractor and a second gear wheel is fixed for rotation with a second spool of the second lap belt retractor, the gear drive assembly connecting the first and second gear wheels and transferring motion between the first and second gear wheels.

21. The vehicle restraint system of claim 20 wherein the first spool rotates in a direction opposite to a direction in which the second spool is rotating during retraction and withdrawal of the first and second lap belts, the gear drive assembly being located in an area between the first and second lap belt retractors and including an even number of drive assembly gear wheels for enabling rotation of the first and second spools in opposite directions.

22. The vehicle restraint system of claim 21 wherein the first spool is identical to the second spool, the first gear wheel is identical to the second gear wheel, and the drive assembly gears are identical to one another.

23. The vehicle restraint system of claim 19 further including first and second shoulder belt retractors for the first and second shoulder belts, respectively, the first and second shoulder belt retractors enabling retraction and withdrawal of the first and second shoulder belts, the first and second shoulder belt retractors being linked together so that the first and second shoulder belts are retracted in unison and by equal amounts during retraction and are withdrawn in unison and by equal amounts during withdrawal from the first and second shoulder belt retractors.

24. The vehicle restraint system of claim 23 wherein a universal joint connects the first and second shoulder belt retractors, the universal joint connecting a first axle of a first spool of the first

shoulder belt retractor and a second axle of a second spool of the second shoulder belt retractor.

25. A vehicle restraint system for helping to restrain a vehicle occupant in a vehicle seat, the vehicle restraint system comprising:

first and second lap belts for collectively extending across a lap of the occupant;

first and second shoulder belts for extending over the shoulders of the occupant;

a buckle assembly for interconnecting the lap belts and the shoulder belts;

linked first and second lap belt retractors for the first and second lap belts, respectively, the linked first and second lap belt retractors retracting the first and second lap belts in unison and by equal amounts during retraction and enabling withdrawal of the first and second lap belts in unison and by equal amounts during withdrawal; and

an indication system, the indication system including sensors for sensing characteristics of the first and second lap belts, respectively, and an indicator for indicating to an occupant that the first and second lap belts and the first and second shoulder

belts are not being worn correctly when the sensed characteristics of the first and second lap belts differ by a predetermined amount.

26. The vehicle restraint system of claim 25 wherein the sensors for sensing characteristics of the first and second lap belts include first and second tension sensors, the first tension sensor sensing tension in the first lap belt and the second tension sensor sensing tension in the second lap belt, the indicator indicating to the occupant that the first and second lap belts and the first and second shoulder belts are not being worn correctly when the sensed tensions of the first and second lap belts differ by the predetermined amount.

27. The vehicle restraint system of claim 25 wherein the linked first and second lap belt retractors are connected by a linking mechanism, the linking mechanism includes first and second sprocket wheels and a chain, the first sprocket wheel being fixed for rotation with a first spool of the first lap belt retractor and the second sprocket wheel being fixed for rotation with a second spool of the second lap belt

retractor, the chain connecting the first and second sprocket wheels and transferring motion between the first and second sprocket wheels.

28. The vehicle restraint system of claim 27 wherein the first spool rotates in a direction opposite to a direction in which the second spool is rotating during retraction and withdrawal of the first and second lap belts, the chain including portions that cross one another in an area between the first and second lap belt retractors for enabling rotation of the first and second spools in opposite directions.

29. The vehicle restraint system of claim 25 wherein the linked first and second lap belt retractors are connected by a linking mechanism, the linking mechanism includes first and second gear wheels and a gear drive assembly, the first gear wheel being fixed for rotation with a first spool of the first lap belt retractor and the second gear wheel being fixed for rotation with a second spool of the second lap belt retractor, the gear drive assembly connecting the first and second gear wheels and transferring motion between the first and second gear wheels.

30. The vehicle restraint system of claim 29 wherein the first spool rotates in a direction opposite to a direction in which the second spool is rotating during retraction and withdrawal of the first and second lap belts, the gear drive assembly being located in an area between the first and second lap belt retractors and including an even number of drive assembly gear wheels for enabling rotation of the first and second spools in opposite directions.

31. The vehicle restraint system of claim 25 further including first and second shoulder belt retractors for the first and second shoulder belts, respectively, the first and second shoulder belt retractors enabling retraction and withdrawal of the first and second shoulder belts, the first and second shoulder belt retractors being linked together so that the first and second shoulder belts are retracted in unison and by equal amounts during retraction and are withdrawn in unison and by equal amounts during withdrawal from the first and second shoulder belt retractors.

32. The vehicle restraint system of claim 31 wherein a universal joint connects the first and second shoulder belt retractors, the universal joint connecting a first axle of a first spool of the first shoulder belt retractor and a second axle of a second spool of the second shoulder belt retractor.